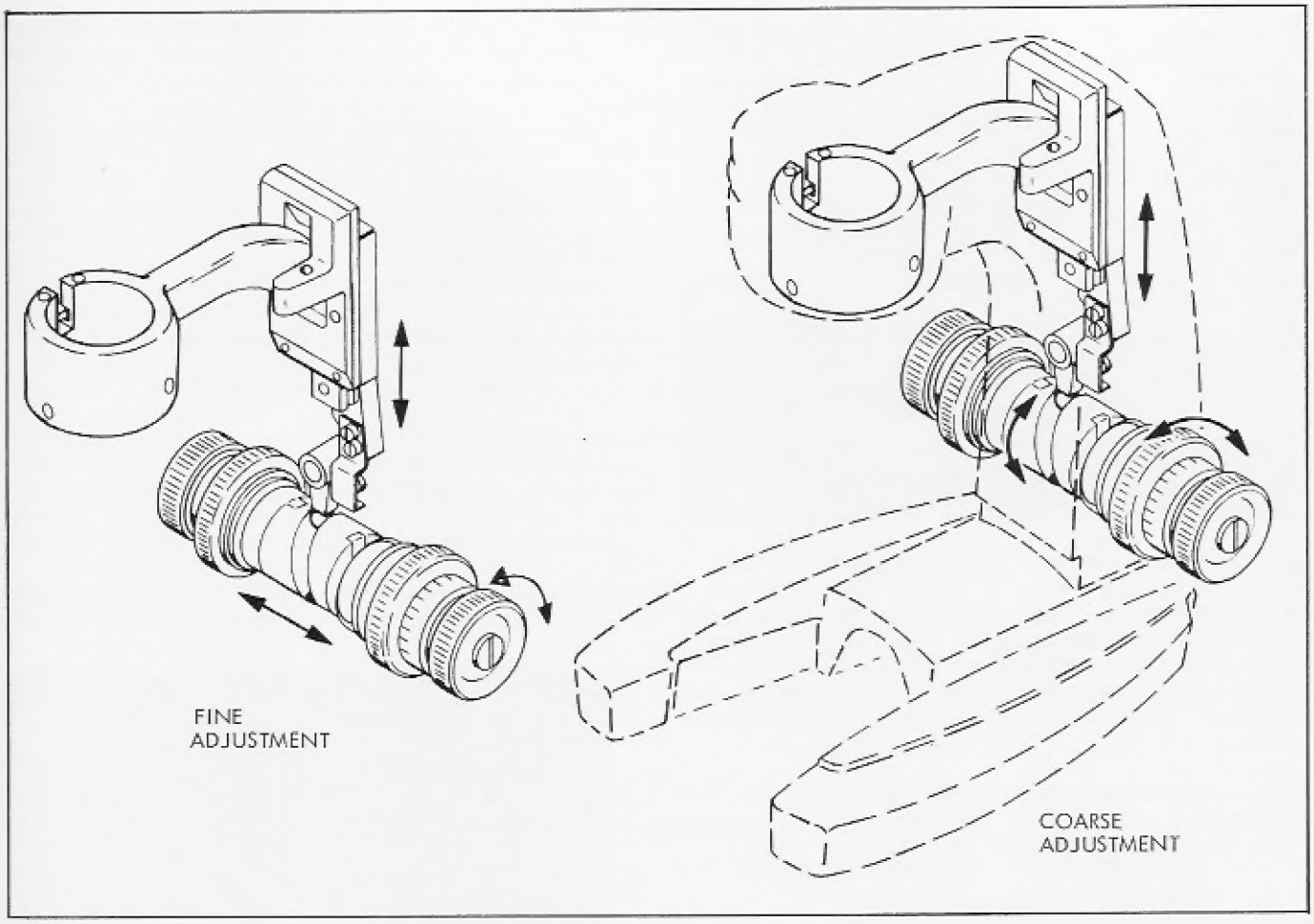


Figure 2. Focusing System

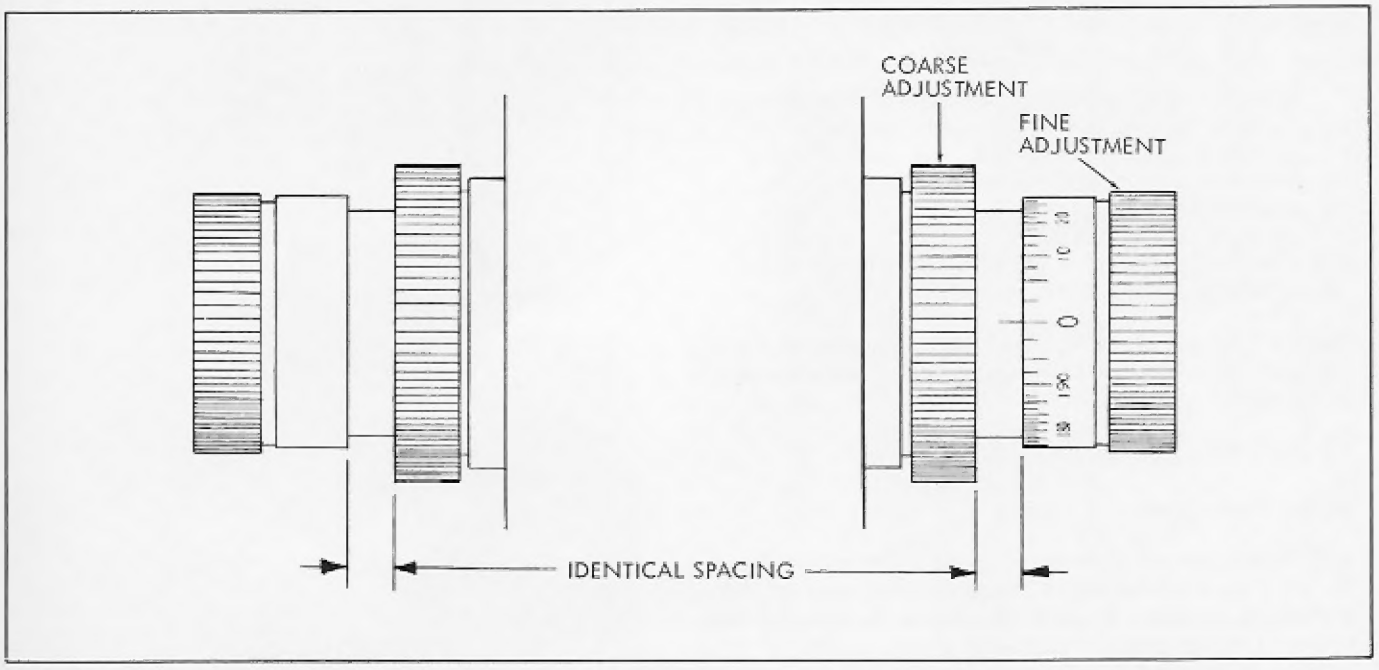


Figure 3. Fine Adjustment

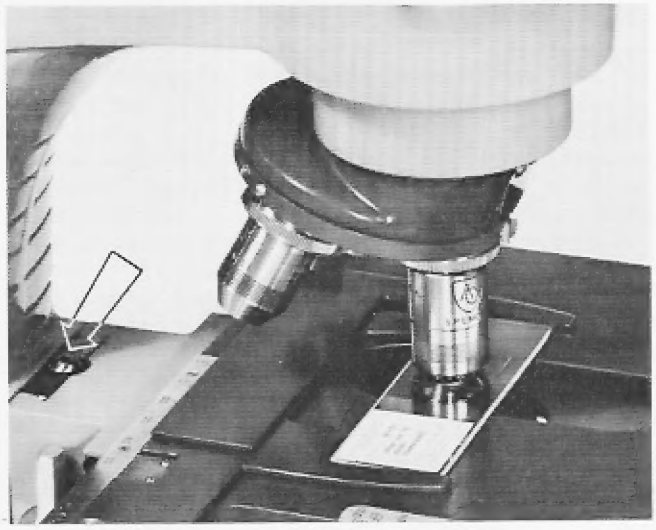


Figure 4. Autofocus Stop

immersion, raise the coarse adjustment, swing to the oil immersion objective, apply oil to slide, and lower the coarse adjustment rapidly to its positive stop. The subject will be in focus within a touch of the fine adjustment with absolutely no danger of touching the slide.

To use the autofocus stop, always start with the fine adjustment approximately in center of its excursion (see figure 3), and proceed as follows:

a. Place slide on stage.

b. Rotate nosepiece to 10X objective.

c. Lower the nosepiece with coarse adjustment to its lowest limit.

Note

Whether the objective is actually lowered through the position of focus, or the position of focus is never reached, the coarse adjustment should be lowered all the way down against the stop.

d. Bring the image of the slide into focus with the fine adjustment control knob.

Repeat this simple procedure each time the slide is changed. This method of focusing will quickly become an automatic procedure.

VI INFINITY CORRECTED OBJECTIVES

1. Description

Most microscopes have been constructed with a fixed distance between eyepiece and objective. The infinity corrected system (figure 5) makes it possible to change the objective to eyepiece distance without affecting optical performance. The new AO concept in infinity corrected objectives makes possible a new breakthrough in optical performance and, at the same time, simplifies the focusing mechanism. This is achieved by focusing the nosepiece only, and not the heavy stage assembly or body tube.

Parallel light emerging from the objective is picked up by a telescope lens in the microscope body tube which brings the parallel rays thus intercepted to focus at the correct position in the eyepiece. Optical performance is in no way impaired by varying the distance from objective to the telescope lens assembly since this merely extends the length of the parallel beam but the addition of the telescope lens system makes it possible to improve optical performance.

2. Table of Objective Characteristics

The pertinent characteristics of this new series of infinity corrected objectives, in combination with recommended eyepieces, are given in Table I.

3. Parfocality and Parcentration

All AO objectives in this series are parfocal. This means that the subject is essentially in focus when the

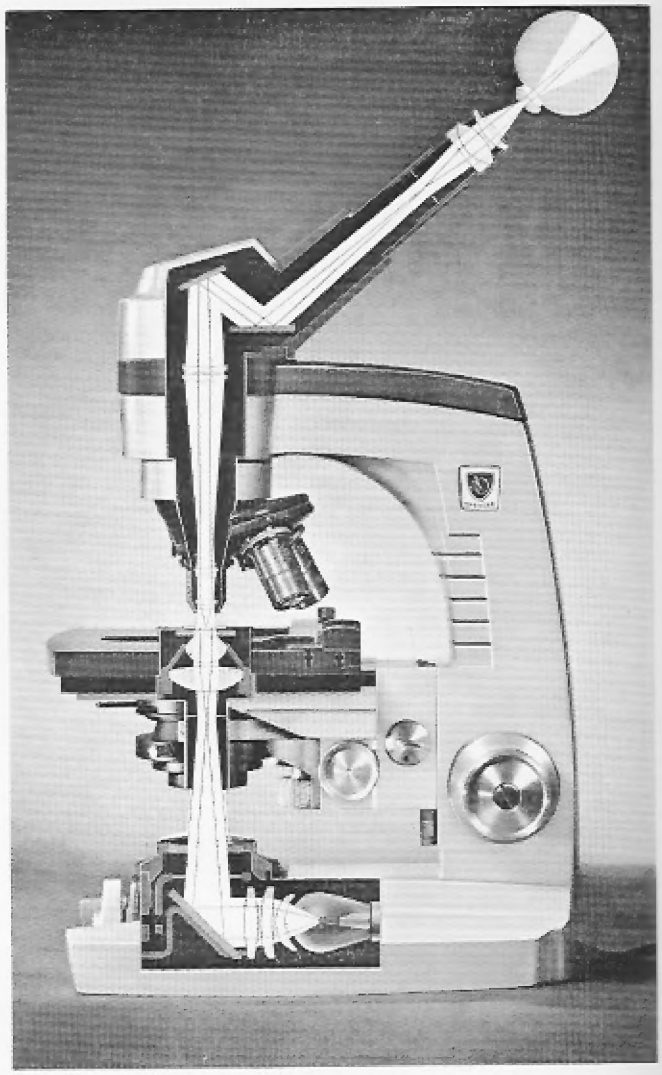


Figure 5. Infinity Corrected System

nosepiece is rotated to change from one magnification to another. With stained slides of normal density, it should always be possible to see an image when going to the next highest power and it is normal to expect a slight touch-up with the fine adjustment.

Parfocality will not be adversely affected by any random selection or arrangement of objectives on the nosepiece.

This new series of objectives is also parcentered. When an area is selected in the center of the field for a given magnification, it will remain well within the field of view for the next highest magnification.

4. Immersion Oil

In addition to a suitable refractive index and dispersion, a satisfactory immersion oil must possess the following physical properties: It should be chemically inert; it should be free from a tendency to spread or creep; it should remain fluid and not harden rapidly when exposed to air; and its optical properties should be stable and not change with age.

Immersion fluids recommended for use with AO objectives are: Cedarwood Oil, Crown Oil or Shillaber's Oil available from AO and most scientific supply houses. Oils of low viscosity, such as mineral oil, will cause damage by seeping up around the mount and into the lens.

VII EYEPIECES

AO Microstar microscopes furnished with achromatic objectives are supplied with either Huygenian or wide field eyepieces.

1. Huygenian Eyepieces

The Huygenian eyepiece is the simplest in construction. As shown in Table I, it has smaller field size and less eye relief than the wide field type. For this reason, it is not recommended for use by observers wearing eyeglasses.

A cross section of the 10X Huygenian eyepiece is shown in figure 6.

Both the 5X eyepiece Cat. No. 133 and the 10X Cat. No. 177 accept reticles of AO 400 series; 21 mm. in diameter. To install a reticle in the Huygenian eyepiece, the reticle must be inserted in the eyepiece from the top with the etched side of the reticle facing down, and secured with a circular spring retainer.

TABLE I

OBJECTIVES					EYEPIECES				
					1. Field of view 2. Eye relief in MM. **				
Catalog Number	Initial Magnification	Focal Length in MM.	Numerical Aperture N. A.	Working * Distance in MM.	5X Huygenian Cat.No.133	10X Huygenian Cat.No.177	10X Wide Field Cat.No.176	15X Wide Field Cat.No.147	20X Wide Field Cat.No.157
1075	4X	46.0	0.12	7.2	1. 4.7 2. 9.5	3.7 8.1	4.6 21.0	4.2 14.0	3.1 10.0
1076	10X	18.0	0.25	9.1	1. 1.9 2. 8.6	1.5 7.9	1.9 21.0	1.7 14.0	1.2 10.0
1077	20X	9.1	0.50	0.8	1. 0.95 2. 7.9	0.74 7.7	0.92 21.0	0.84 14.0	0.61 10.0
1078	45X	4.0	0.66	0.3***	1. 0.42 2. 7.7	0.33 7.6	0.41 21.0	0.37 14.0	0.27 10.0
1079	100X	1.8	1.25	0.1	1. 0.19 2. 7.0	0.15 7.5	0.18 21.0	0.17 14.0	0.12 10.0
1116	45X	4.0	0.66	0.7	1. 0.42 2. 7.7	0.33 7.6	0.41 21.0	0.37 14.0	0.27 10.0

NOTES:
* All working distances in air above a 0.18 MM Coverglass.
** Eye relief is distance from exit pupil (ideal position of eye) to top of eyepiece lens.
*** Working distance of 0.3 in air + 0.18 coverglass, equivalent to 0.63 in glass. Ample clearance for 0.4 MM thick coverglass used with Hemacytometer.

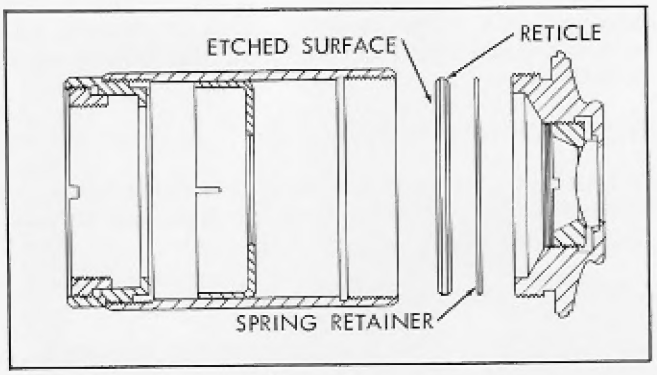


Figure 6. 10X Huygenian Eyepiece

2. Wide Field Eyepieces

This eyepiece is of greater complexity and provides an increased field of view. It will be noted from Table I that the 10X wide field has essentially the same field of view as the 5X Huygenian eyepiece. It also provides a higher eyepoint, that is, for this reason, definitely recommended for observers wearing eyeglasses.

The series is available in three different magnifications:

10X wide field - Cat. No. 176
15X wide field - Cat. No. 147
20X wide field - Cat. No. 157

Figure 7 shows a cross section of the wide field eyepiece. To insert a reticle into the eyepiece, place the reticle into the reticle mount with the etched side facing outward, and slide the mounted reticle into the eyepiece tube with the etched side of the reticle upwards until the reticle seats against the field diaphragm.

3. Calibration of Micrometer Disc

The projected values of reticle graduations vary with the optical combination used, and consequently, should be pre-calibrated before accurate measurements can be made. To calibrate, focus on a stage micrometer and move it until one of the graduations corresponds exactly with one of the divisions of the eyepiece micrometer. (See figure 8.) The true distance (X) seen on the stage micrometer, which corresponds to the number of divisions (Y) of the eyepiece micrometer disc, is then read and dividing this true distance by the number of divisions of the eyepiece micrometer, it is possible to find the distance each division subtends (C = X/Y). The number of divisions covered by the specimen multiplied by the calibration constant (C) gives the length of the specimen.

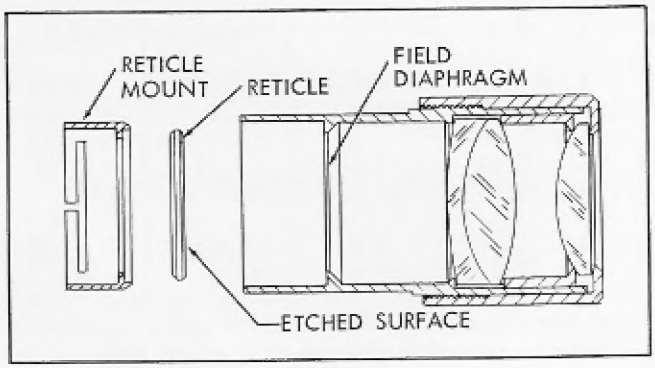


Figure 7. Wide Field Eyepiece

VIII STAGES

1. Types and Construction

There are two basic groups of stages furnished for use with the Series 10 Microstar. One group incorporates the simple bakelite stage, Micro-Glide stage, or rotating stage. See figures 9 and 10. This two-piece constructed stage, illustrated in figure 10, consists of the top portion (simple, glide, or rotating) which is supported in a ring mount and bracket. The top portion is identical to and interchangeable with stages furnished on previous Series 2 and Series 4 Microstar microscopes.

The stage is attached to the stand by means of a dovetail slide. In use, the stage assembly is locked at a fixed position on the slide, the height determined by position of the autofocus stop. Adjustment on the slide is made only when one wishes to accommodate unusually thick vessels such as tissue culture bottles or wet mounts.

The other group consists of the graduated or un-graduated mechanical stage. See figures 11 and 13. The mechanical stage is a one-piece construction and attaches to the stand in exactly the same manner as the two-piece constructed stage.

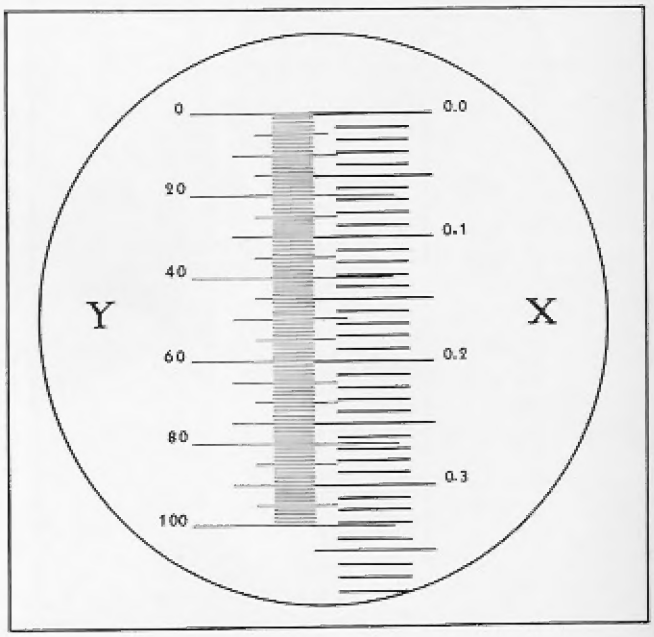


Figure 8. Calibration of Micrometer Discs

Figure 9. Stages

Both groups of stages are adjustable in height and locked at the desired position by means of the locking lever. With slides of normal thickness the stage is raised to its uppermost position, against the preset autofocus stop. This stop is set at the factory for a slide thickness of approximately 1.5 mm. and provides, with the 2 mm. excursion of the fine adjustment, satisfactory use of the autofocus stop with any slide of thickness from 0.5 mm. to 2.5 mm.

2. Changing Stages

Remove the stage assembly as follows (see figure 12):

a. Remove autofocus stop screw (figure 4).

b. Remove all objectives from nosepiece.

c. Raise nosepiece to upper limit with coarse adjustment.

d. With mechanical stages, center the elongated hole in the top stage plate to the hub of the nosepiece by moving the stage top in a north-south direction.

e. While supporting the stage in one hand, unlock locking lever and raise the entire assembly from the dovetail slide, tilting it forward at the top of the slide to clear the nosepiece.

Replace the stage assembly as follows (see figure 13):

a. Make sure the top stage plate is centered to the hub in a north-south direction so that the nosepiece hub will not interfere.

b. Make sure the locking plate will not interfere.

c. Tilt the stage assembly forward to carefully engage the slide, and lower to correct position.

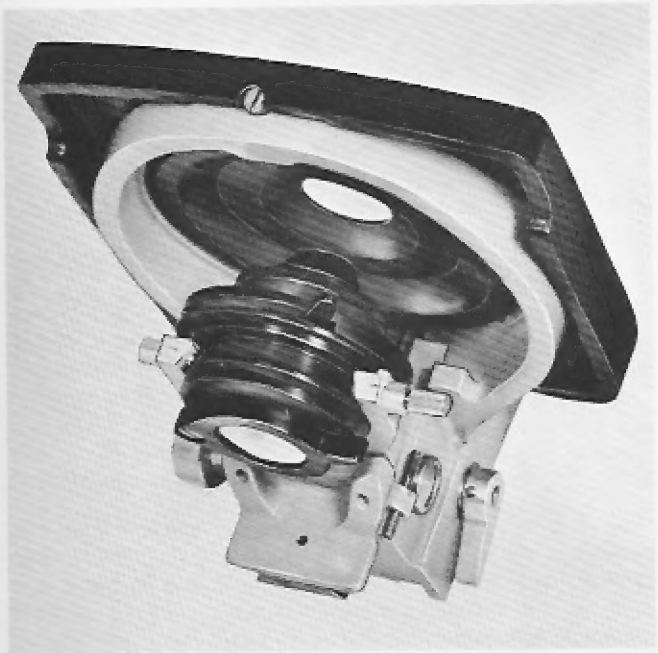


Figure 10. Plain Stage

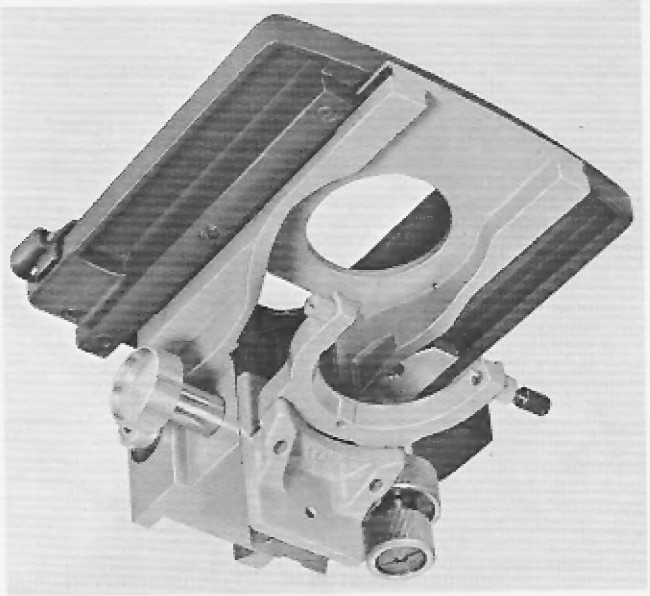


Figure 11. Mechanical Stages

Figure 12. Removal of Stage Assembly

d. Replace objectives on nosepiece.

e. Lock the locking lever.

f. Insert autofocus screw with Allen wrench and adjust for correct autofocus stop setting as follows:

(1) Use slide of normal thickness (approximately 1.25 mm).

(2) With 10X objective, lower nosepiece all the way to its stop with the coarse adjustment.

(3) Set fine adjustment approximately in the center of its range.

(4) Raise stage until image is in focus. Lock with locking lever.

(5) Advance autofocus screw downward until it contacts the top of the dovetail slide and becomes a stop which limits further upward movement of the stage.

3. Mechanical Stage

The slide carrier assembly is easily removed by unscrewing the two knurled screws. See figure 13. The lateral movement of the finger, actuated by the pinch grip, should be free and respond instantly to the spring action which causes the finger to hold the slide firmly in place. If clean, it should require no lubrication.

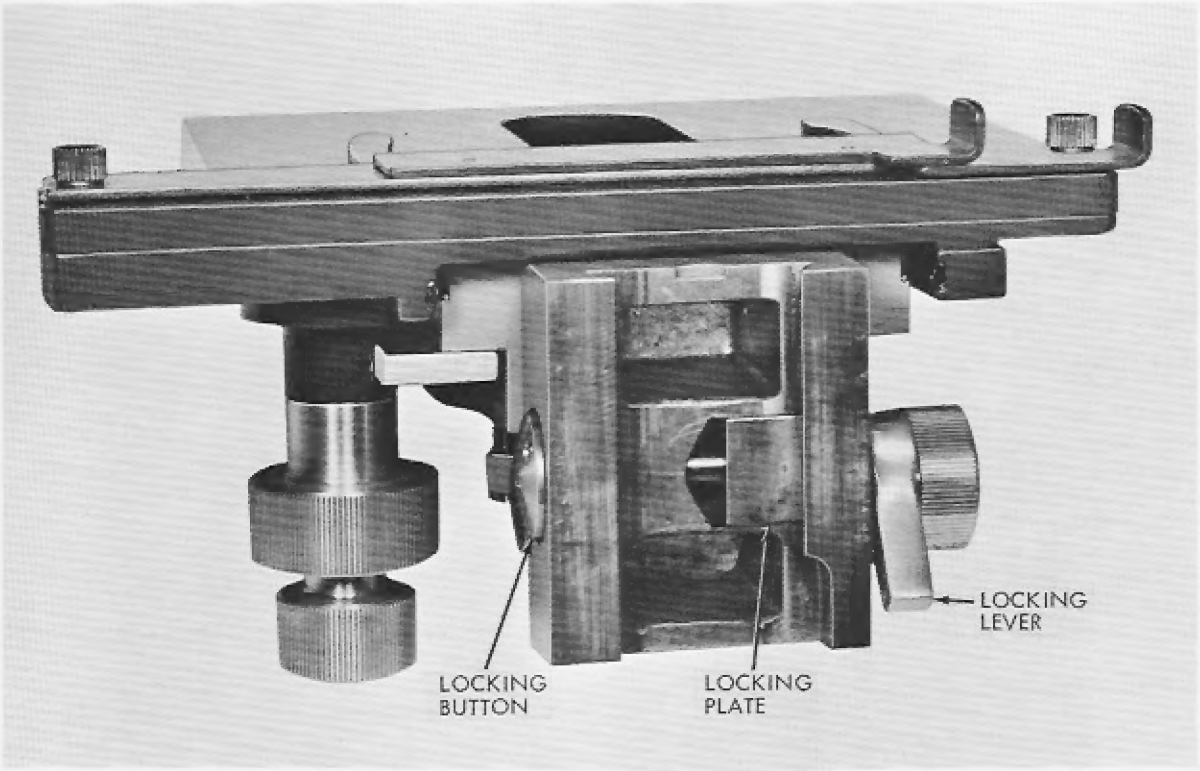


Figure 13. Rear View of Stage Assembly Slide

The forward and lateral motions of the stage are on prelubricated bearing ways.

4. Simple Stage

The simple bakelite stage is easily installed or removed from its support ring. See figure 14. When installing the simple stage, make sure the lock screw is backed off far enough for the stage to seat properly. Tighten the lock screw snugly but do not force.

5. Micro-Glide Stage

The Micro-Glide stage depends for successful operation on a film of lubricant of proper viscosity applied uniformly on the inner sliding surfaces. It requires periodic maintenance in relubricating these surfaces. Frequency of relubrication required depends on the environmental conditions and frequency of use. To relubricate, separate the upper plate from the lower plate by forcing apart. Completely remove all the old grease with a solvent such as xylene or alcohol, and relubricate using the lubricant supplied with the stage. Use sparingly and spread in a thin film over both plates with finger or a cloth. Reassembly and work in by moving the top plate around for a few seconds.

6. Rotating Stage

Two types of rotating stages are provided; one plain, Cat. No. 1536, and one with Micro-Glide top, Cat. No. 1537. The rotating action is on a prelubricated ball bearing.

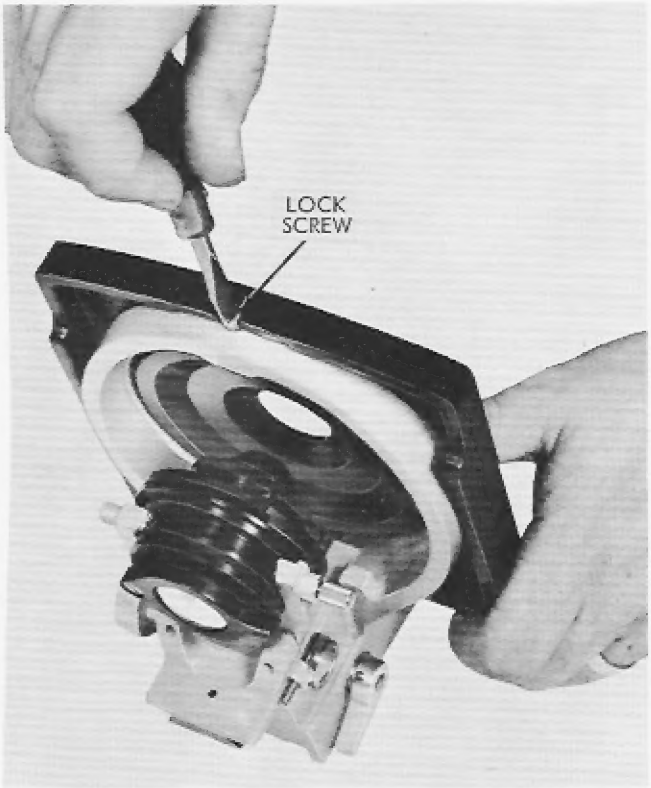


Figure 14. Removal of Simple Stage

IX SUBSTAGE EQUIPMENT

1. Rack and Pinion Focus

On the new Microstar Series 10 models, the fork mount which supports the substage condenser is actuated by rack and pinion. The maximum height of the condenser has been properly adjusted at the factory to just below stage level. If it becomes necessary to readjust the height of the condenser, proceed as illustrated in figure 15, advancing or retracting the Allen head stop screw as necessary.

2. Fork Mount

The condenser assembly is easily removed from the fork mount by backing off the thumb screw and pulling the entire condenser assembly forward. See figure 16. To reassemble the condenser to the fork mount, be sure that the slot in the back of the condenser mount seats into the pin in the fork mount. See figure 17. Insert the condenser mount all the way into the fork and then rotate until the pin engages the slot.

3. Focusing Tension

Adjust the focusing tension by turning knob while holding slotted nut on the opposite side stationary with a screwdriver or coin. (See figure 18.)

4. Condenser Mount

Two types of condenser mounts are provided; (1) fixed mount, Cat. No. 1093, and (2) centerable mount, Cat. No. 1095. The fixed mount is pre-centered at the factory and requires no further adjustment.

The centerable mount provides the ultimate in centration and is usually necessary only for advanced techniques. Centration is best accomplished by removing the eyepiece and observing the image of the aperture diaphragm with a pinhole eyepiece or centering telescope. This adjustment should be made when the objective is properly focused on a slide and the condenser is in correct operating position.

Both condenser mounts are furnished with an iris diaphragm which controls the effective numerical aperture of the objective.

A filter slot is incorporated at the lower side of the condenser mount. This slot accepts filters of 33 mm. diameter such as blue daylight filters or ground glass filters, special colored filters, simple dark-field stop, polaroid disc, etc.

5. Condensers

a. Abbe Condenser, N.A. 1.25, Cat. No. 1088. This condenser is recommended for advanced

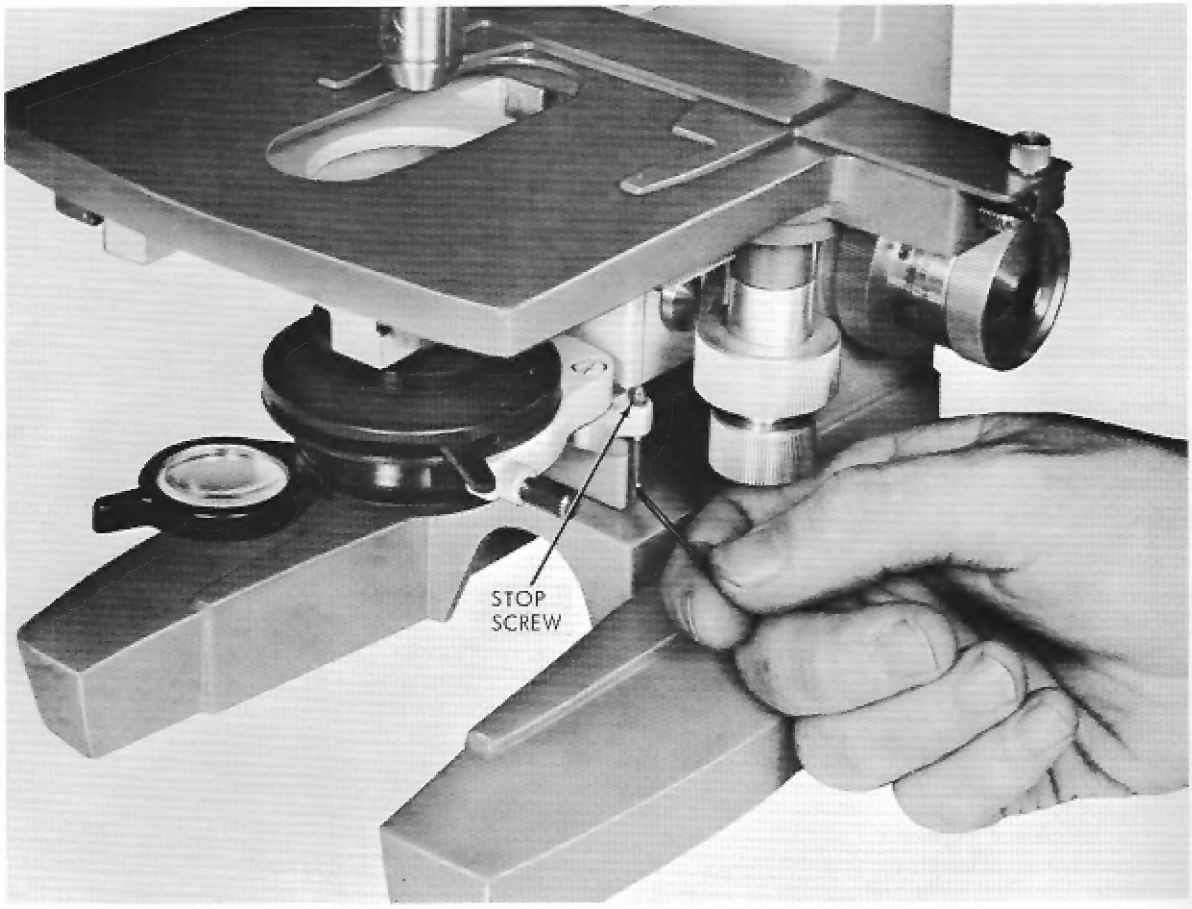


Figure 15. Adjusting Condenser Heights

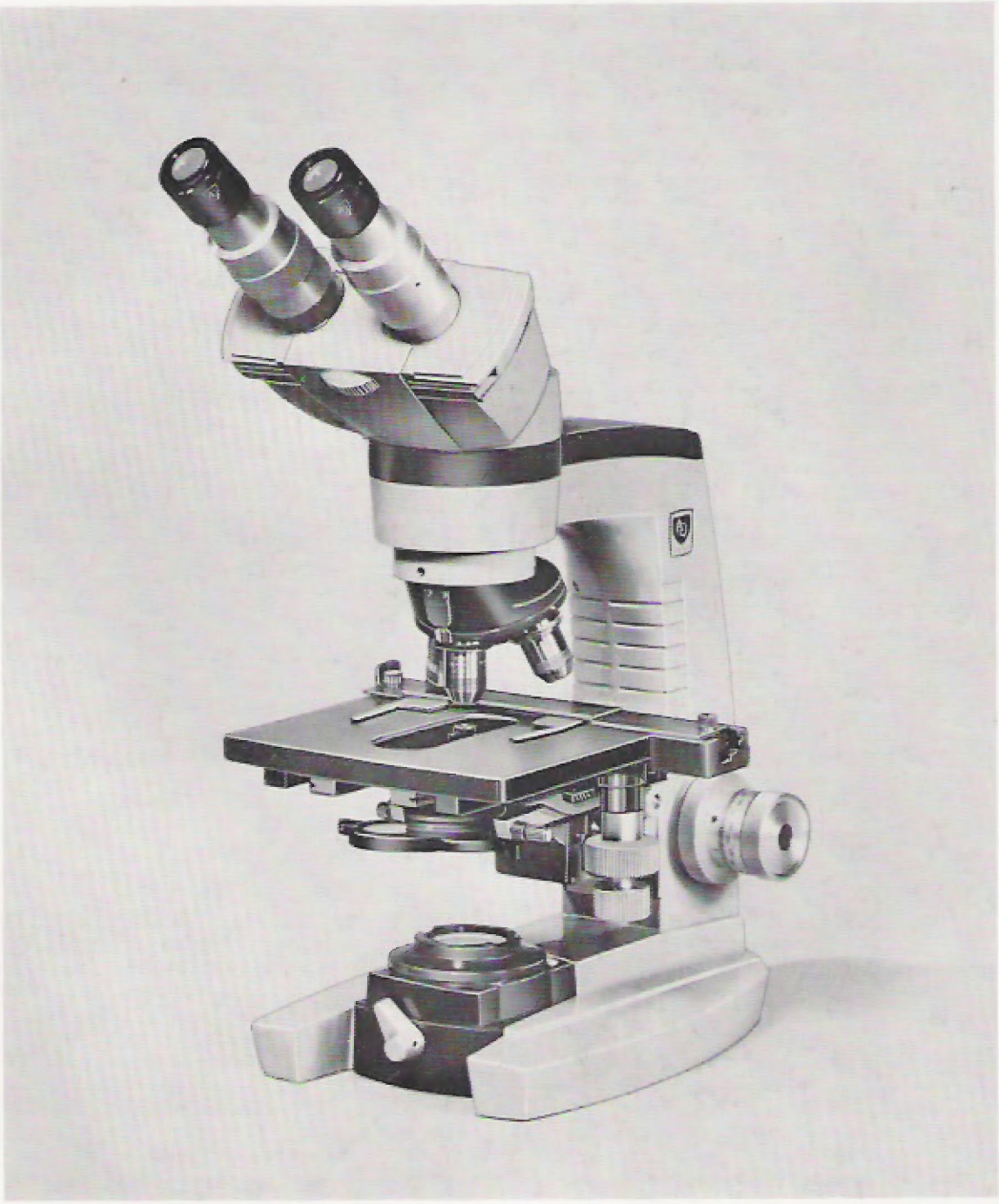
TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

REFERENCE MANUAL

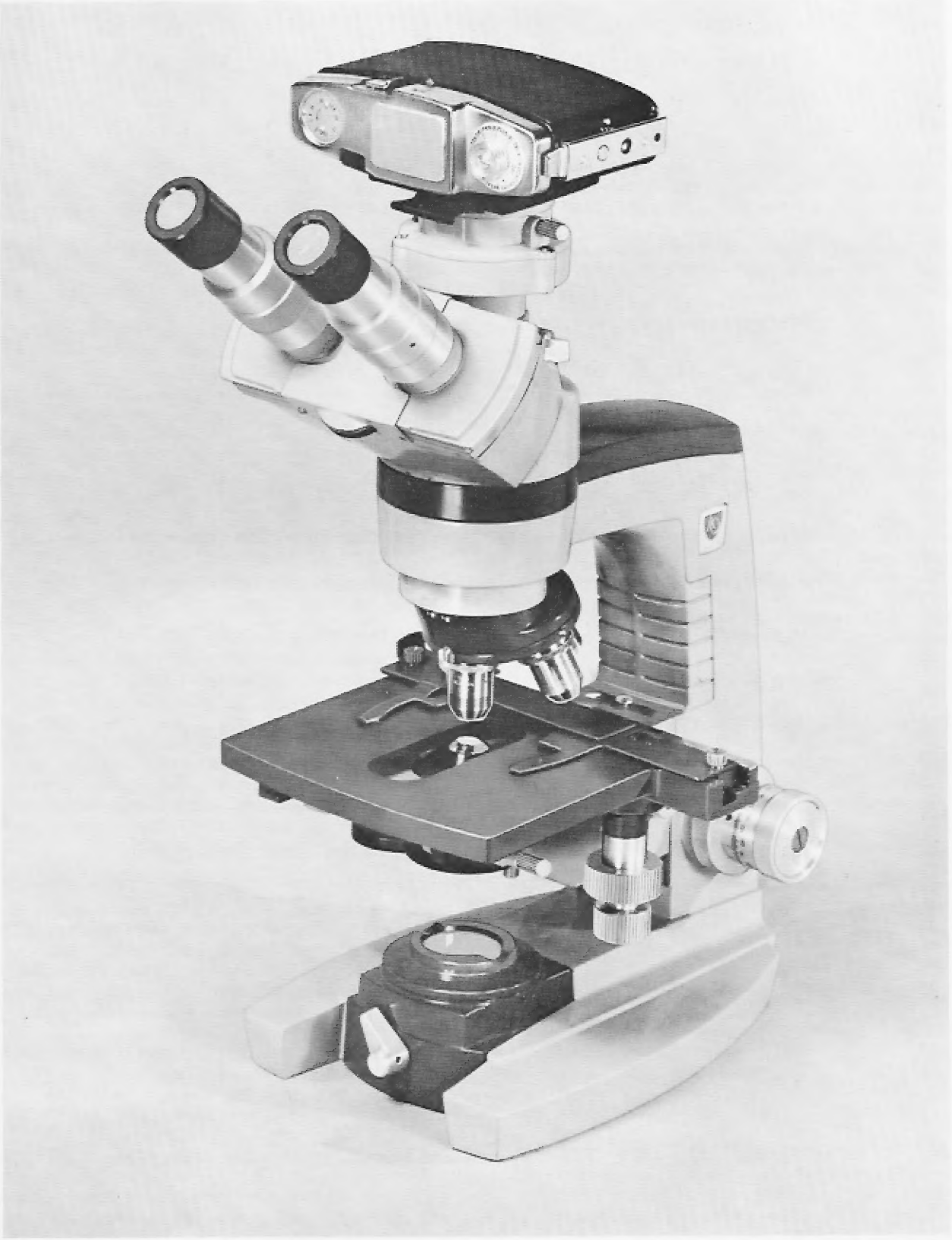
Series 10 MICROSTAR

Advanced Laboratory Microscopes



AMERICAN OPTICAL COMPANY
INSTRUMENT DIVISION • BUFFALO, NEW YORK 14215

Price $1.00



MICROSTAR Series 10 Microscope

IMPORTANT

As a safeguard your AO Microstar has been equipped with the following feature. Should the downward excursion of the coarse and fine adjustment be limited to an extent which prevents focussing on a slide of normal thickness, it may easily be released. Simply turn the coarse adjustment knob in the direction which raises the objectives to the positive stop at the top of the coarse adjustment excursion.

This adjustment is not to be confused with improper adjustment of stage height. The stage should be raised to the upper limit permitted by the autofocus stop (See pages 2, 3, & 4, Figures 3 & 4).

AO MICROSTAR SERIES 10 MICROSCOPE

I INTRODUCTION

The AO-Spencer Microstar represents the finest and most advanced laboratory microscope ever produced; the latest in a long series of fine microscopes produced over a span of 115 years. With proper care, it will give a lifetime of satisfactory, dependable use.

This Reference Manual is written on the assumption that it is to be used by advanced students and experienced microscopists. No attempt has been made to include fundamentals and basic principles of microscopy. It is condensed to cover the essential functional adjustments and controls specific to the AO Microstar Series 10, together with a complete listing of parts with exploded drawings. It also covers routine maintenance requirements. If the reader is interested in a more complete treatise on fundamentals and principles of the microscope, AO will be pleased to forward, at no charge, our booklet entitled "Effective Use and Proper Care of the Microscope".

II GUARANTEE

The AO-Spencer Microstar is guaranteed unconditionally against defects in material or workmanship. With care and a minimum of maintenance, it will provide a lifetime of satisfactory, dependable service. This guarantee cannot be extended to cover damage in transit or damage caused by carelessness, misuse, or conditions beyond our control. Please note carefully the conditions relating to damage in transit in the paragraph immediately following.

III DAMAGE IN TRANSIT

Modern and effective methods of packaging have been carefully considered to ensure that the Microstar arrives in "factory new" condition. Each microscope is thoroughly inspected before leaving the factory, and with careful handling during shipment, delivery of the microscope in good condition is assured.

The transportation company, when it accepts the shipment, becomes the cosignee's agent and is responsible for safe delivery. If, upon delivery, the outside of the packing case shows evidence of rough handling or damage, the transportation company's agent should be requested to make a "Received in Bad Order" notation on the delivery receipt. If there is no exterior evidence of rough handling upon delivery but concealed damage is evident on unpacking the shipment, the transportation company should, within 48 hours of delivery, be requested to make out a "Bad Order" report. This procedure is necessary in order to maintain the right of recovery from the carrier.

If it should be necessary after consultation with the transportation agent to ultimately return any material to us, it is requested that you communicate with us before actually returning any goods. After arrangements have been made for the return, the material should be plainly tagged with the sender's name and address, carefully packed and shipped prepaid. Please indicate the date and number of the packing list in a letter to us.

IV UNPACKING AND ASSEMBLY

The method of packaging the new Microstar takes advantage of modern packaging materials and techniques plus the quick and easy interchange of component assemblies which has been engineered into the design of this modern microscope. Each microscope is fully assembled and thoroughly inspected at the factory. The subsequent removal of component assemblies for convenience and safety in transit in no way impairs the ultimate performance of the microscope. Precise functional alignment is assured by manufacturing techniques and design. Simply follow these instructions for quick assembly of the instrument. If it is desired, the AO dealer or AO representative will be pleased to assist with the assembly of the microscope.

Note

Contents of inner carton are clearly marked including accessories such as body, objectives, eyepieces, mirror and fork assembly (if ordered without illuminator), transformer for "In-Base" illuminator (if so ordered), blue glass filter (where supplied), immersion oil, plastic cover, reference manual, and two Allen wrenches.

1. Unpacking

Unpack the microscope as follows:

a. Stand carton upright and open from top.

b. Lift out the inner carton by means of the two finger holes provided.

c. Remove separators in the inner carton, and lift stand from lower carton.

d. Remove material used to restrain movement of the mechanical stage, and remove the foam pads from under the stage support, and under the nosepiece assembly.

Note

The plastic bag used for protection in handling and shipping can be discarded since a permanent, heavy duty plastic cover is included with the microscope.

2. Attaching Body to Stand

Attach body to stand by backing off knurled screw, inserting dovetail in body support and tightening the knurled screw firmly without forcing. See figure 1. The body is thus precisely located on the optical axis of the microscope, regardless of the orientation selected. The AO Microstar may be used in either of two positions; arm toward the observer, or arm away from the observer. It is assumed that microscopes with attached or built-in illuminators will be used with the arm away from the observer.

3. Assembling Objectives to Nosepiece

Screw objectives into the nosepiece openings. It is customary to arrange the sequence of magnification from lowest magnification to next highest by rotating the nosepiece clockwise. It makes no difference which hole is selected for the first objective. Precision tolerances held in the manufacture of AO objectives make random selection possible without affecting centration or parfocality. Be sure that the objectives are seated firmly against the shoulder of the nosepiece by tightening snugly. Do not force.

4. Connection of Illuminator

The illuminator may now be connected to its power supply. Illuminators, Cat. No. 1034 and No. 1037, plug directly into 115 volt AC outlet. Cat. No. 1036 Illuminator connects through a variable transformer to the 115 volt AC outlet.

If the microscope is ordered with a mirror for use with an external light source, the mirror fork assembly, packed in the accessory box, should be inserted firmly into the hole provided in the base.

Figure 1. Attaching Binocular Body to Stand

V FOCUSING

1. AO's New Focusing Concept

The AO Microstar incorporates a new focusing concept of unprecedented convenience and effectiveness in which only the nosepiece moves in focusing. The basic construction is shown in figure 2. The nosepiece is raised and lowered by the concentric coarse and fine adjustment knobs. The entire internal focusing mechanism is totally enclosed and sealed against entry of dirt. Movement of the nosepiece on a ball-bearing slideway, ensures smooth, positive action, free of backlash.

2. Coarse Adjustment

Positive stops are provided for both the upper and lower position of the coarse adjustment control knob. Excursion provided is ample for slides or chambers. For use with tissue culture bottles, etc., where greater clearance is required, the stage can be immediately lowered and locked to the desired position. Maximum clearance thus provided is 1-5/8". Relubrication and tension readjustment of coarse adjustment are rarely required.

3. Fine Adjustment

A micrometer screw, graduated in microns for fine adjustment, has a total excursion of 2 mm. or 10 complete revolutions. Each revolution represents a movement of 200 microns. It will be extremely helpful to learn to recognize when the fine adjustment is midway in its operating range. See figure 3. This midway position is the correct setting to provide the necessary operating range to effectively use AO's unique autofocus stop.

The fine adjustment mechanism moves on the same ball bearing slideway as the coarse adjustment. Relubrication and tension readjustment are rarely required.

4. Autofocus Stop

Autofocus is an indispensible aid to microscopy. This concept, pioneered by AO over 15 years ago, is a tremendous time saver in using the coarse adjustment, particularly with the oil immersion objective.

The autofocus stop is pre-set at the factory. It is the stop which limits the height of the stage (see figure 4). This setting is valid for slides anywhere from 0.50 to 2.5 mm. in thickness. Because of the highly precise tolerances held in the manufacture of the objectives (affecting both parcentration and parfocality), it is possible to search the slide with 10X or 45X objectives, find the field required for study under oil